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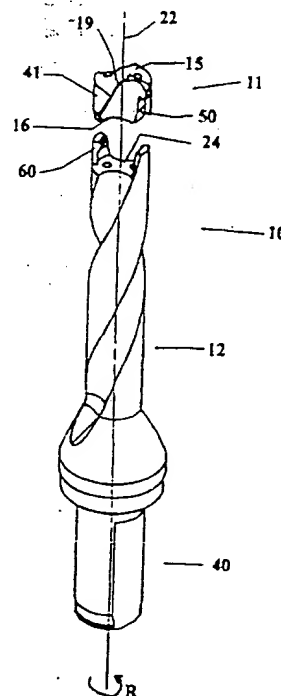
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: TOOL FOR CUTTING MACHINING

(57) Abstract

The present invention relates to a tool and a cutting portion for cutting machining. The tool in operative situation preferably rotates around its longitudinal center axis. The tool comprises a tool body (12) and a cutting portion (11). The tool body has a front surface (24) and the cutting portion has a support surface (16) provided to releasably abut against each other. The front surface and the support surface comprise cooperating projections (60) and recesses (50), which are provided to transfer the cutting forces arising during machining via a bayonet coupling. The invention also relates to a cutting portion and a tool body as well as a method for mounting a cutting portion to a tool body.



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Tool for cutting machining

The present invention relates to a tool for rotary, cutting machining, comprising a tool body and a cutting portion. The tool body has a front surface and the cutting
5 portion has a support surface provided to releaseably abut against each other in a substantially radial plane. The tool body and the cutting portion comprises means which cooperate for holding them together. The invention also relates to a cutting portion and a tool body as well as a method for mounting a cutting
10 portion to a tool body.

Prior art

It is previously known to use interchangeable cutting edges on different types of tools for cutting machining, especially in a metallic workpiece. This technique
15 however has yet its practical limitation due to handling reasons when it comes to milling and drilling tools which rotate around its longitudinal axis.

Through DE-PS-367,010 and US-A-2,259,611, it is previously known to provide drills with lockable drill tips, wherein the drill tip is retained with the aid of dove-
20 tail profiles and with press fit, respectively. The known tools however are impaired with drawbacks such as bad torsion transferring ability and troublesome mounting and dismounting.

The present invention has as one object to provide a design of drilling and
25 milling tools with interchangeable cutting edges, wherein said design eliminates problems with known technique.

Another object with the present invention is provide a rigid tool preferably for
30 drilling or milling, wherein the cutting portion cooperates with the tool body via a bayonet coupling.

Another object of the present invention is to provide a rigid tool preferably for drilling or milling wherein the cutting portion easily can be exchanged for hand without time consuming screwing or soldering.

5 Another object of the present invention is to provide a tool with a self centering cutting portion.

These and other objects have been achieved by a tool and a drill tip such as they are defined in the appended claims with reference to the drawings.

10

Description of the drawings

Fig. 1 shows a drilling tool according to the present invention, in an exploded view. Fig. 2 shows a cutting portion according to the present invention in a bottom view. Fig. 3 shows the cutting portion in a side view according to the line
15 III-III in Fig. 2. Fig. 3A shows the cutting portion in a perspective view from below. Fig. 4 shows the forward end surface of a tool body according to the present invention in top view. Fig. 5 shows the drill shank in a side view according to the line VI-VI in Fig. 4. Fig. 6, 7 and 8 show cross-sections of a bayonet coupling of the tool. Fig. 9 shows the tool according to Fig. 1 in
20 magnification.

Detailed description of the invention

The embodiment of a tool 10 according to the invention shown in Fig. 1 is a so called helix drill, which comprises a cutting portion or drill tip 11 and a drill body
25 12. The drill has a rotational direction R.

The drill tip 11 is provided with at least one cutting edge 19 in the of the drill tip 11 forward end at the end facing away from the drill body 12, which tip is given different designs depending on the area of application.

30

The drill tip 11 is made in hard material, preferably cemented carbide and most preferably in injection moulded cemented carbide and comprises two upper clearance surfaces 15, a support surface 16 as well as them uniting first 41 and second 18 curved surfaces. All these surfaces and associated edges are
5 integrated with the drill tip and consequently performed in the same material, i.e. preferably injection moulded cemented carbide. Lines of intersection between the second curved surfaces or the chip flutes 18 and the clearance surfaces 15 form main cutting edges 19, preferably via reinforcing chamfers, not shown. Lines of intersection between the first curved surfaces 41 and the chip flutes 18
10 form secondary cutting edges. The chip flute may alternatively be adapted for a drill body with straight chip flutes. The radially external parts between the chip flutes consist of protruding lands 41, each having a circumferential length G. The largest diameter of the drill tip is the diametral distance between the radial extreme points of the secondary cutting edges. The height of the drill tip is
15 substantially the same as the largest diameter of the tip, in order to minimize the wear from chips on the joint between the drill tip and the drill body. Flushing holes 23, substantially parallel with the rotational axis 22, extend through the drill tip from the support surface 16 to the orifice in respective upper clearance surface 15.

20 The support surface 16 according to Figs. 2, 3 and 3A is substantially planar but comprises a recess 50 at the transition between the support surface and each the jacket surface of the land 41. Each recess 50 comprises a first free surface 51 perpendicularly connected to the jacket surface, which perpendicularly
25 connects to a second free surface 52, which in turn forms an acute angle α , Fig. 6, with a first guiding surface 53, which connects to a second guiding surface 54 parallel to the rotational axis 22, which connects to the support surface 16 via a radius or an entering bevel 55. The recess 50 has a stop surface 56, Fig. 3A, which is parallel to the axis 22 and which suitably lies in an axial plane which
30 intersects said axis. The recess 50 extends in the tangential direction from the

chip flute 18 to about half way of the tangential length L of the associated land 41.

The drill body is made in a material which has a lower Young's modulus than cemented carbide. The drill body has screw shaped chip flutes 18 or straight chip flutes and these can extend along the entire body or along a part thereof. The drill body 12 is provided with a front surface 24 at the end facing towards the drill tip 11, which surface is provided to abut against the support surface 16 of the drill tip 11. The largest diameter of the support surface is larger than the largest diameter of the front surface in order to minimize the wear from chips on the joint between the drill tip and the drill body. The front surface 24 is substantially planar but comprises a projection 60 at the transition between the front surface and the jacket surface of each land 41. The height of the projection is somewhat less than of the recess 50 depth. Each projection 60 comprises a first free surface 61 perpendicularly connected to the jacket surface, said surface perpendicularly connecting to a second free surface 62, which in its turn forms a pointed angle π with a first guiding surface 63, which connects to a second guiding surface 64 parallel to the rotational axis 22, which surface 64 connects to the front surface 24 via a radius 65. The projection 60 has a stop surface 66, Fig. 9, which is parallel with the axis 22 and which suitably lies in an axial plane which intersects said axis. The smallest diameter of the front surface is smaller than the largest diameter of the drill tip but larger than the smallest diameter of the drill tip. The projection 60 extends in the tangential direction from the chip flute 18 to about the half of the tangential length G of the associated land 41.

The stop surfaces 56 and 66, respectively, should be as far from the rotational axis as possible for best moment transfer, i.e. they are arranged diametrically opposed each other. The drill tip must be symmetrically formed in order to retain the tool's concentricity at varying strain, i.e. in order to keep the drill tip centered relative to the drill body. The projections 60 and the recesses 50 lie at a distance

from and substantially rearwardly of the associated cutting edge 19 in the tool's rotational direction R.

5 Mounting of the drill tip 11 on the drill body 12 is done as follows. The drill tip 11 is brought in the direction towards the drill body 12, so that each projection 60 reaches into the associated chip flute and so that the support surface 16 abuts against the front surface 24. Then, the drill tip is rotated in the direction R within an angle interval ϕ which is less than 360° , preferably less than 60° , relative to the drill body so that the projection is allowed to move with slide fit in the recess 10 until the stop surfaces 56 and 66 abut against each other. The drill tip 11 is now anchored in the drill body 12 in a satisfactory manner. Thus, the preformed spaces of the chip flutes 18 are used as the entrance and the exit of the bayonet coupling.

15 When the drill tip 11 shall be exchanged, the mounting procedure is reversed. The drill tip 11 then can be removed from the drill body 12 and be exchanged, preferably with the aid of a suitable key in engagement with the chip flutes on the drill tip. Said key and key grip are preferably used also at mounting.

20 The surfaces which during the drilling operation must be in engagement are surfaces 53 and 63 as well as the support surface 16 and the front surface 24. The surfaces 53 and 63 cooperate to hold the drill tip such that it cannot loosen in the feed direction, for example at retraction of the tool. The surfaces 53 and 63 are preferably designed such that their cooperation results in some elastic 25 deflection of the projection 60 due to the slide fit. A limited contact surface between 54 and 64 can be allowed. The latter however implies a increased moment at the radius 65. The drill tip is self centering in the tool body, i.e. it moves such that its axis coincides with the rotational axis 22 if it has been displaced during the machining operation. The surface 55 will allow a relatively 30 great radius 65 of the tool body. The surfaces 52 and 62 should not be in engagement with each other during the machining operation. That is realized by

having the surface 53 is extended. The clearance surfaces 51 and 61 should not be in engagement with each other during the machining operation, and therefore a gap P always arises between them. The gap P is 0,1 - 1,0 mm. The support surface 16 will be forced by the feed force against the front surface 24 during the machining operation, which means that the elastic deflection of the projection tends to decrease somewhat, which however is counteracted by that the projection will be bent radially inwardly due to pressure on the front surface 24 from the feed force.

- 10 The invention is useable also for milling cutters. The drill tip is preferably coated with layers of for example Al_2O_3 , TiN and/or TiCN. In certain cases it can be well-founded to apply super hard material such as CBN or PCD on the cutting edges. Alternatively ceramic material can be used at injection moulding of the drill tips.
- 15 The invention is in no way limited to the above described embodiment, but may freely be varied within the limits of the appended claims.

Claims

1. Tool for relative to a metallic work piece rotary cutting machining, including a tool body (12) and a cutting portion (11), wherein the tool body has a shank portion (40), a front surface (24) and chip flutes (18), wherein the cutting portion has a support surface (16) provided to releasably abut against the front surface, wherein the tool body and the cutting portion comprise means which cooperate to hold them together, characterized in that said means comprise cooperating projections (60) and recesses (50), which are intended to be rotated relative to each other in connection with mounting of the cutting portion to the tool body to form a bayonet coupling, said rotation occurring within an angle interval (ϕ) and in that the preformed spaces of the chip flutes (18) are used as the entrance and the exit of the bayonet coupling.
2. Tool according to claim 1, characterized in that the cooperating projections (60) and recesses (50) are provided in connection with the peripheries of the cutting portion and of the tool body and that the angle interval (ϕ) is less than 360° , preferably less than 60° .
3. Tool according to anyone of claims 1 or 2, characterized in that the cooperating projections (60) and recesses (50) comprise surfaces (53,63) angled relative to the tool's axis of rotation (22) intended to receive the forces directed forwardly in the tool's feed direction.
4. Tool according to claims 1, 2 or 3, characterized in that the tool body (12) has a lower Young's modulus than the cutting portion (11) in order for the projections (60) to be able to elastically bent in the tool's radial direction in connection with mounting and machining and that the projections (60) and the recesses (50) lie at a distance

from and substantially rearwardly of the associated cutting edge (19) in the tool's rotational direction (R).

5. Tool according to anyone of the preceding claims,

5. characterized in that the projections (60) and the recesses (50) extend in the tangential direction from the chip flute (18) to about the half of the tangential length (G) of the associated land (41).

6. Tool according to anyone of the preceding claims,

10. characterized in that a gap (P) is provided between the most peripheral surfaces (51,61) of the cutting portion and of the tool body, said surfaces facing each other.

7. Cutting portion for rotary chip removing machining, wherein the cutting portion

15. (11) has a circular basic shape and at least one cutting edge (19), which is integral with the cutting portion (11), which is provided with a support surface (16) at the end facing away from the cutting edge, said cutting portion comprising at least one chip flute (18),

20. characterized in that the support surface (16) of the cutting portion comprises means (50) for constituting a part of a bayonet coupling provided to be able to be rotated within an angle interval (ϕ) and that the means extend in the tangential direction from the chip flute (18).

8. Cutting portion according to claim 7,

25. characterized in that the means consist of projections (60) or recesses (50), which are provided diametrically opposed in connection with the periphery of the cutting portion and that the means extend in the tangential direction from the chip flute (18) to about the half the tangential length (G) of the associated land (41) and that the angle interval (ϕ) is less than 360° , preferably less than
30. 60° .

9. Tool body for a tool for rotary chip removing machining, including a shank portion (40), chip flutes (18) and a front surface (24), said body having a center axis (22),

5 characterized in that the front surface (24) of the tool body comprises means (60) for constituting a part of an bayonet coupling and that the means extend in the tangential direction from the associated chip flute (18).

10. Tool body according to claims 9,

10 characterized in that the means consist of projections (60) or recesses (50), which are provided diametrically opposed in connection with the periphery of the tool body.

15 11. Method for mounting a cutting portion to a tool body to form a tool for relative to a metallic work piece rotary cutting machining, said tool including a tool body (12) and a cutting portion (11), wherein the tool body has a shank portion (40), a front surface (24) and chip flutes (18), wherein the cutting portion has a support surface (16) provided to releaseably abut against the front surface, wherein the tool body and the cutting portion comprise means which cooperate to hold them together,

20 characterized in that the method comprises the following steps:

- provide complementary projections (60) and recesses (50) on the cutting portion (11) and on the tool body (12),
- bring the cutting portion (11) in a direction towards the tool body (12), so that each projection (60) reaches into an opposed chip flute (18) and so that the support surface (16) abuts against the front surface (24),
- 25 - rotate the cutting portion (11) within an angle interval (ϕ) in a direction (R) relative to the tool body so that each projection is allowed to slide into the associated recess until stop surfaces (56,66) of each projection and recess abut against each other.

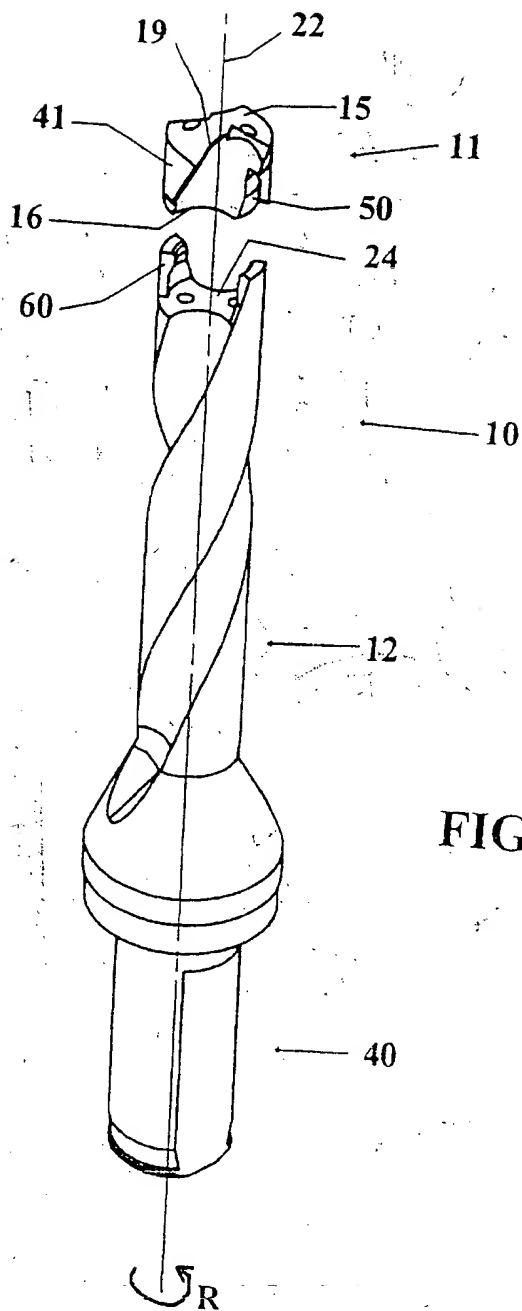


FIG. 1

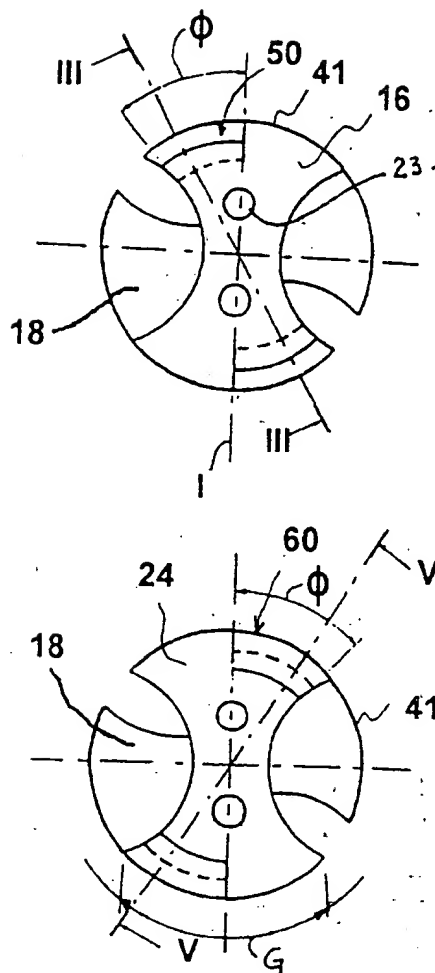


Fig. 4

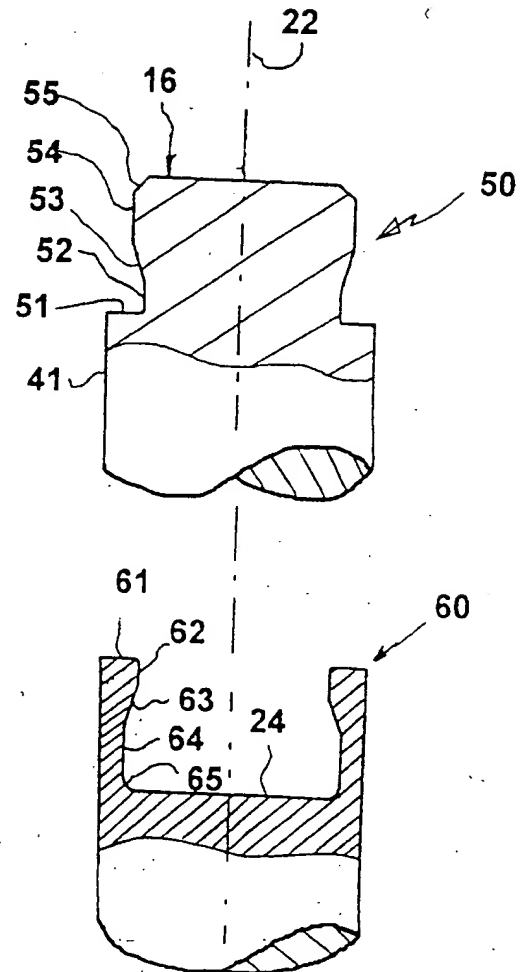
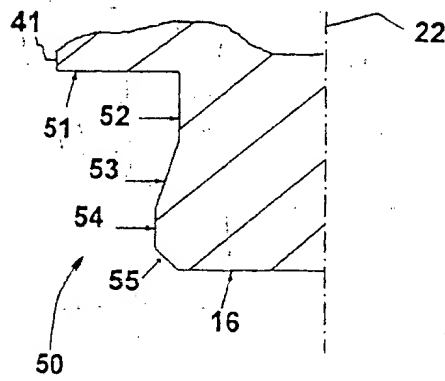
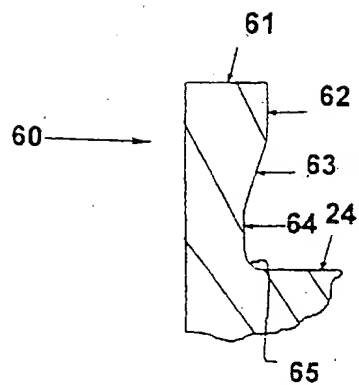
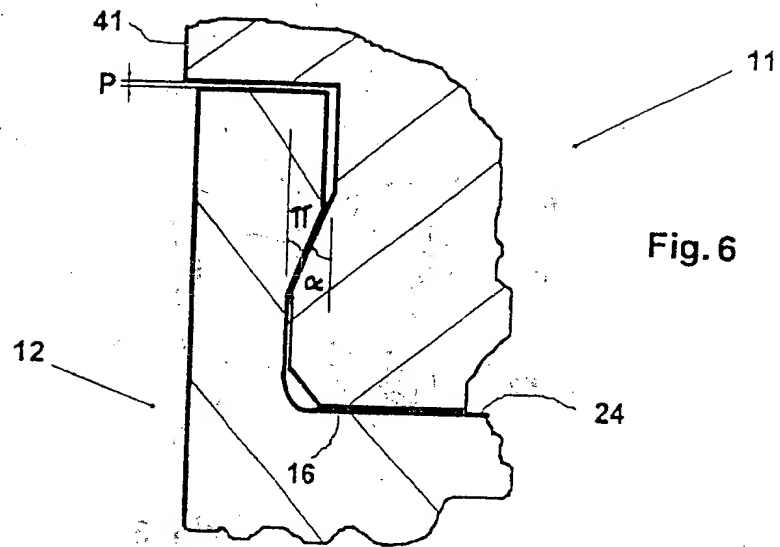


Fig. 5



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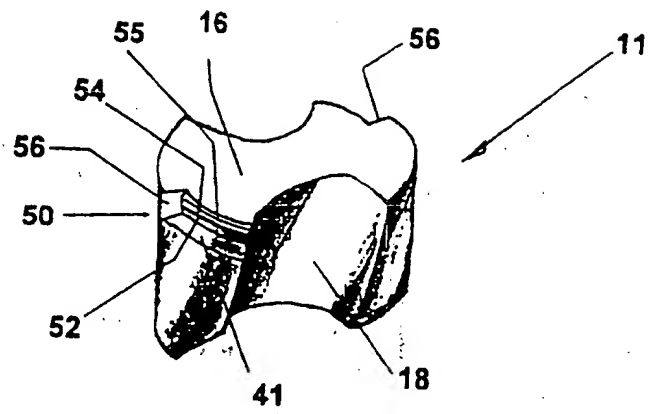


Fig. 3A

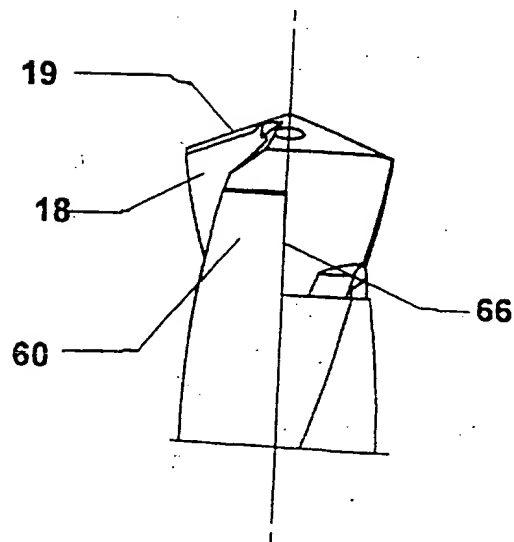


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/01509

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B23B 51/00, B23B 51/02

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0691484 A1 (GEISSLER & KUPER GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG), 10 January 1996 (10.01.96), figure 1	1,2,6,7,9, 10,11
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A	DE 19605157 A1 (KOMET PRÄZISIONSWERKZEUGE ROBERT BREUNING GMBH), 5 Sept 1996 (05.09.96), figure 5a	1,2,6,7,9, 10,11
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A	DE 367010 C (GEORG SAMUEL), 15 February 1923 (15.02.23), figures 1-8	1-11
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A	SE 447880 B (SANTRADE LTD), 22 December 1986 (22.12.86), figure 1	1-11
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 2259611 A (G.M. BURGER), 21 October 1941 (21.10.41), figures 1,2</p> <p>---</p> <p>-----</p>	1-11

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/97

International application No.

PCT/SE 97/01509

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